

# Asymptotics of conditional probabilities of succesful allocation of random number of particles into cells

Afonina A., Kayumov I., Chuprunov A.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

---

## Abstract

© 2017 Walter de Gruyter GmbH, Berlin/Boston 2017. The article is devoted to the memory of Valentin Fedorovich Kolchin. Let  $\zeta_i$  ( $i \in \mathbb{N}$ ) be independent identically distributed nonnegative integer-valued random variables,  $(\eta_{i1}, \dots, \eta_{iN})$  be the fillings of cells in the generalized scheme of allocation of  $\zeta_i$  particles into  $N$  cells,  $1 \leq i \leq n$ , for fixed  $Z_n = (\zeta_1, \dots, \zeta_n)$  these allocation schemes are independent. We consider the conditional probabilities  $P(A_{n,N} | Z_n)$  of the event  $A_{n,N} = \{\text{each cell in each of } n \text{ allocation schemes contains no more than } r \text{ particles}\}$ , where  $r$  is some fixed number. The sufficient conditions for the convergence of the sequence  $P(A_{n,N} | Z_n)$  to a nonrandom limit with probability 1 are given. It is shown that the random variable  $\ln P(A_{n,N} | Z_n)$  is asymptotically normal. Applications of the obtained results to the noise-proof encoding are discussed.

<http://dx.doi.org/10.1515/dma-2017-0028>

---

## Keywords

Cauchy integral, generalized allocation scheme, Hamming code

## References

- [1] Kolchin V. F., "One class of limit theorems for condition distributions", Lit. matem. sb., 8:1 (1968), 53-63 (in Russian).
- [2] Kolchin V. F., Random Graphs, Cambridge University Press, 1998, 268 pp.
- [3] Timashev A. N., Asymptotic expansions in probabilistic combinatorics, M.: Nauchn. izd-vo TVP, 2011 (in Russian), 312 pp.
- [4] Timashev A. N., Generalized allocation scheme in problems of probabilistic combinatorics, M. : Izd. dom "Akademiya", 2011 (in Russian), 268 pp.
- [5] Timashev A. N., Large deviations in probabilistic combinatorics, M. : Izd. dom "Akademiya", 2011 (in Russian), 248 pp.
- [6] Pavlov Yu. L., Random Forests, VSP, Utrecht, 2000.
- [7] Kolchin A. V., "On limit theorems for the generalised allocation scheme", Discrete Math. Appl., 13:6 (2003), 627-636.
- [8] Kolchin A. V., Kolchin V. F., "On transition of distributions of sums of independent identically distributed random variables from one lattice to another in the generalised allocation scheme", Discrete Math. Appl., 16:6 (2006), 527-540.
- [9] Kolchin A. V., Kolchin V. F., "On the transition of distributions of sums of random variables related to the generalised allocation scheme from one lattice to another", Discrete Math. Appl., 17:5 (2007), 455-461.
- [10] Novikov F.A., Discrete mathematics for programmers, Piter, 2004 (in Russian).

- [11] Avkhadiev F. G., Chuprunov A. N., "The probability of a successful allocation of ball groups by boxes", Lobachevskii J.Math., 25 (2007), 3-7.
- [12] Avkhadiev F.G., Kayumov I.R., Chuprunov A.N., "An investigation of the probability of successful allocation of particles in cells by methods of complex analysis", Trudy Matem. Tsentra im. N.I. Lobachevskogo, 19 (2003), 6-7 (in Russian).
- [13] Kayumov I. R., Chuprunov A. N., "The probability of successful allocation of particles in cells (the general case)", J. Math. Sci., 209:1 (2015), 88-95.
- [14] Chuprunov A.N., Khamdeev B.I., "On the probability of error correction under noise-eliminating coding when the number of errors belongs to a finite set", Inform. i ee primen., 3:3 "Probabilistic-statistical methods and tasks of informatics and information technologies" (2009), 52-59 (in Russian).
- [15] Chuprunov A. N., Khamdeev B. I., "The probability of correcting errors by an antinoise coding method when the number of errors belongs to a random set", Russian Math. (Iz. VUZ), 54:8 (2010), 67-73.
- [16] Chuprunov A. N., Khamdeev B. I., "On probability of correction of a random number of errors in an error-correcting coding", Discrete Math. Appl., 20:2 (2010), 179-190.